Instructions for assembling the GINO-MIDI INTERFACE
Small-Midi version 3

Disclaimer
Before you start building any of the projects on this website, keep in mind that I can't be held responsible for any damage that is caused by building and using the designs related to the GINO-MIDI Interface. All effort has been done to make the schematics and instructions as correct as possible and the whole project is successfully tested and used by not only me, but also by others then me.

Partlist Masterprint Small-Midi 3 Interface
Semiconductors
IC1 74HCT139 (dual 4 to 1 address decoder IC)
IC2 AT89C2051 (Pre-programmed GINO-Core IC)
IC3 78T05 (voltage regulator) 1A
Q1 BC547b Transistor (NPN)
Q2 BC547b Transistor (NPN)

Resistors
R1 1K ¼ watt
R2 220 ohm ¼ watt
R3 10K ¼ watt
R4 220 ohm ¼ watt
R5 470K ¼ watt
R6 4K7 ohm ¼ watt
R7 470 ohm ¼ watt
RN1 Resistor network, 8 x 22K , common out (¼ watt)

Capacitors
C1 1uF/16v (Electrolytic or tantalum)
C2 100nF (ceramic or disc)
C3 33pF (ceramic or disc)
C4 33pF (ceramic or disc)
C5 100uF/25v (Electrolytic or tantalum)
C6 100nF (ceramic or disc)
C7 10uF/16v (Electrolytic or tantalum)
C8 100nF (ceramic or disc)
C9 100nF (ceramic or disc)

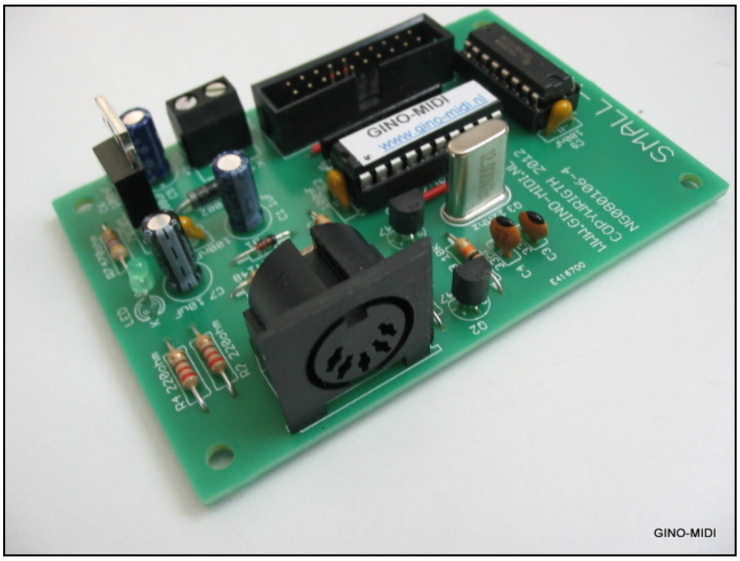
Crystal
Q3 X-tal 12 Mhz

Diode's
D1 1N4148 General diode, also needed for the keyboard/switches
D2 1N4001 of 1N4002 (Voltage rectifier diode)
LED1 Standard green led

Several parts
1 DIN 5 Pin Right Angle PCB Mount Socket
1 IC socket 16 pin for the 74HCT139
1 IC socket 20 pin for the AT89C2051 processor
1 20 Pin IDC Male Header (for the 20-wire flatcable) for the GINO-BUS
1 Electric (isolated) wire for the bridge-connection on the GINO Core-board
1 Terminal Block (Side Entry) 2 pos.
1 Parker 3 x 20 mm
1 Spacer / Afstandsbus
1 PCB GINO NG080106-4

Introduction
The Small-Midi 3 interface is designed to add MIDI-capabilities to organ manuals or other keyboard instruments. With the Small-Midi 3 interface it is possible to create an organ console to play virtual organ software through the soundcard of a computer, or to use an expander (for example Content, Domus, Ahlborn).
With this MIDI interface it is easy to build an affordable alternative for a digital pipe-organ or theatre organ. It allows the user to use any organ that they like, without the restrictions of a digital organ. At the moment there are several software-bundles that can be used for playing virtual organs. Some are freeware, and some are not.
Examples are (Commercial) Hauptwerk and (Freeware): MyOrgan, Toccata, and JOrgan. This MIDI interface is different from other MIDI-controllers because the Small-Midi 3 interface is a complete set for 2 manuals of 5 octaves each plus a (up to 32-note) pedal plus up to 64 stop- or control switches. Another option is to use a third manual instead of the pedal.

The circuit
The heart of the Small-Midi 3 Interface consists of the circuit around the microcontroller AT89C2051. The microcontroller reads keystrokes, thus goes to work and translates it to midi codes.The circuit around this microcontroller you can find it in the file with the title Masterprint on the page Downloads of the website. This schematic shows the powercircuit, the circuit around the microcontroller and the midi output.



The keyboards and the register panel are connected through a ribbon cable to this circuit,
through the IDC male header 2520. This flat cable I call this guide GINO-Bus.
A stabile and accurate clock-signal of 12 MHz is generated by Q3, (which is a 12 MHz Quartz-crystal) and capacitors C3 and C4.
The Reset-circuit has 3 components: C1, D1 and R6. This circuit generates a reset-pulse whenever the GINO-MIDI interface is powered-up. This makes that the software inside the Small-MIDI 3 interface is started from the beginning and initializes at the same time several other protocols, like Note-offs.

The MIDI-signal from the TXD-pin on the microprocessor is inverted by Q2 (BC547 or BC547B), and then transmitted through Q1 to the 5-PIN MIDI-connector. From decoder IC1A only the half is used. This is an address-decoder that decides which one of the 4 ports (manual, switches, and pedal) shall be read.

The power is supplied by a 78T05 Voltage regulator. It is able to deliver 5 volts at 1A. The power supply itself should not deliver more then 12 DC. You can use any available AC-DC adapter, like the one from a MP3-player etc. Watch the POLARITY!!!

The software inside the AT89C2051 reads in a very high tempo the messages that it receives from the decoders that are attached to the manuals and pedal and switches. These data is the almost real-time converted into MIDI signals. This has the advantage that the latency (the time between pressing a key and hearing a sound) is really low.

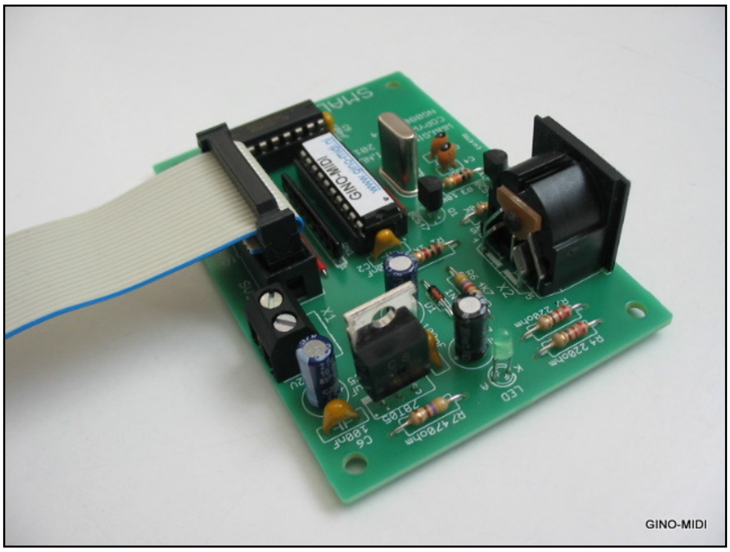
Each keyboard (manual, pedal, and switch) is read-out by a decoder. This decoder requires that the keyboard has to be wired in a so called matrix. This matrix is a group of 8 keys or switches, connected to a diode (1N4148). For each 8 Keys you need 8 diodes.
Each decoder can read (decode) 64 keys. Most keyboards are limited to 61 Keys (5 octave).

Before a diode-matrix can be encoded we need a circuit that is able to read what key is pressed and translates that to a pulse. That pulse is sent through the GINO-Bus to the AT89C2051. This decoder is controlled by IC1A and the AT89C2051and sends 8 pulses per cycle. With every pulse the AT89C2051 scans a part of the diode-matrix.

To bring back the wiring to a minimum (also for building compact consoles) all the manuals, pedal and switches are connected through a 20-wire flat cable, called the GINO-Bus. Each manual is linked through the next, and then finally ends in the Small-MIDI 3 Main board.

Midi-channels and ports.
For more information about Midi-messages, ports and channels you can find many resources on the internet. This manual will not cover these messages and ports in depth, only the use of MIDI-channels and a little about ports.
Probably as you know, MIDI can send data over 16 channels (channel 10 is mostly used for percussion like drums etc.) The Small-MIDI 3 interface sends data over three channels. These are channel 1, 2 and 3. The MIDI-messages from the manuals and pedal are Note On and Note-Off messages. (pressed or released keys).
Beside that, the switches send a different kind of message. These are so called "Program Changes". The switches are also wired in a matrix. But the Program Change messages are always sent through MIDI-Channel 1. The ports used by the Small-MIDI 3 interface are user-selectable by jumpers. The Small-MIDI 3 interface works with 4 port-numbers 1, 2, 3 and 4.
Port 1 is defined for stop-control
Port 2 can be used for channel 1. This can be Manual I
Port 3 can be used for channel 2. This can be manual II
Port 4 can be used for channel 3. This can be Pedal.
You can use port 2 to 4 any way you want, but port 1 is reserved for the switches. It is hard-coded (not changeable).
With the jumper on every decoder-board, each port and channel can be configured as the user desires to do so. The only exception is port 0. This port is non-changable.

Diode matrix



In this schematic you can see that we use a diode-matrix to find out which key is pressed or what the selected stop is. The diode-matrix is activated by the decoder. This decoder is activated by the mainboard and will access the correct part of the matrix. The only disadvantage is that you have to rewire a manual, pedal or switches and order the keys in groups of 8. The buss bar has to be divided in 8 parts, for each 8 keys or switches. The required diodes are really inexpensive (1N4148).

(An alternative method for using the GINO-MIDI with a common buss-bar system is to use a multiplexer board, existing from buffer/line-drivers with a resistor-network that is able to read the voltage from a common bussbar system and translates it to signals that are compatible with the GINO-MIDI interface. Since different organ manufacturers uses different voltage-levels for their common buss-bar (from -20 Volts to +32 Volts), the muliplexer has to be designed for every specific organ.)

Power consumption.
The circuit uses a current of 23 mA. This is largely consumed by the micro processor and the led.
The 74HCT139 consumes almost nothing, and is not measurable.
If the decoder circuits 74HCT138 with matrices for the keypads and / or pedal and the registry switches are connected to the main board no power increase.
This type of HCT draw almost no power.

Testing.
Without using a keyboard, etc. you can already test the circuit. First let's see if the voltage is present. Place no ICs in the sockets. Look at the plus and minus of the connection.
For power supply you can use an adapter that generates a voltage of 8 to 12 volts DC. Note that the voltage of 12 volts should not be exceeded. Idle is the 12 volt soon15 volt, and because this circuit draws almost no power, the voltage will not be reduced by the load.
Pay attention to the polarity of the adapter. The center pin is plus and the outside is the minus.

Note. Use an on / off switch. Do not plug the adapter without an on / off switch in the socket.
The reset circuit may not work properly.

Measure the voltage on pin 20 of the IC socket for IC2. Corrective action must be 5volts. If this is not the case, then walk the circuit again thoroughly. IC3 is well connected? These are some of those easy mistakes.

If the supply is good, you can put IC1 and IC2 in the sockets. Note the direction of the ICs. Then connect the MIDI Out to the PC or with a MIDI instrument.
Then switch the power on. There will apparently nothing happen, because we have not connected any decoder and diode array. Still the circuit has send a midi signal. Namely, the codes for All-Notes-Off. More on that later.
We will now simulate a keyboard. Make a short circuit between pin 17 and pin 6 of the 2520 IDC male header. You will now need to hear any response from your MIDI device. We simulate now that we have pressed the first key of each matrix. That's a lot of tones we will hear now and it gives a lot of noise, but it's just a way to note that the heart of the midi interface works.
If you have a MIDI monitor program on your computer you can follow the output of the midi codes.

Do you get no response, it is essential that you examine the circuit again properly. You can also see if the first midi signal (All-Notes-Off) is transmitted.
For each of the 16 channels this code is transmitted and can be followed on a midi monitor. Below is a link where you can download a midi monitor.

http://www.midiox.com

It is very useful to have this kind of software on the PC. On the Internet, many applications can be found. Please take a look.

GINO-Bus
The GINO bus connects all the decoder circuitry with the main board. Below is specification of this bus.

Pennr IDC connector	Name	Discription
X1-20	PORT 1	Signal registerpanel
X1-18	PORT 2	Signal keyboard/pedal
X1-16	PORT 3	Signal keyboard/pedal
X1-14	PORT 4	Signal keyboard/pedal
X1-12	PORT 5	Only applicable to the BIGMIDI
X1-10	PORT 6	Only applicable to the BIGMIDI
X1-8	PORT 7	Only applicable to the BIGMIDI
X1-6	A2	Adres 2 for decoders
X1-4	A1	Adres 1 for decoders
X1-2	A0	Adres 0 for decoders
X1-1	GND	Massa
X1-3	D7	Data 7
X1-5	D6	Data 6
X1-7	D5	Data 5
X1-9	D4	Data 4
X1-11	D3	Data 3
X1-13	D2	Data 2
X1-15	D1	Data 1
X1-17	D0	Data 0
X1-19	+ 5 VOLT	Supply 5 volt

All-Notes-Off
When you see the scheme of the matrix of port 1 you will notice a switch S110 signed last. This is not a last key of the keyboard, but a separate additional switch in the matrix. If this switch is closed, the midi interface will send an All Notes Off-code signal for all 16 channels.
This message is also sent when you turn on the MIDI interface every time.

Finally
I have tried in this guide to mention many items according to building this Small-MIDI 3 interface. If you have remarks and comments, please let me know. Also my English is a little bit poor, so feel free to correct me. This allows other users to take advantage of them. Good luck with the construction of the Small-Midi 3 Interface

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